

U.S. Department of Energy Orders Self-Study Program

29 CFR 1910.147

**THE CONTROL OF HAZARDOUS ENERGY
(LOCKOUT/TAGOUT)**



ALBUQUERQUE OPERATIONS OFFICE

29 CFR 1910.147
THE CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)
FAMILIAR LEVEL

OBJECTIVES

Given the Familiar Level of this module and the resources, you will be able to perform the following:

1. State the purpose of implementing 29 CFR 1910.147.
2. Define the following terms.
 - affected employee
 - authorized employee
 - hot tap
 - tagout
 - lockout
 - lockout device
 - energy isolating device
 - tagout device
3. State the conditions that require a contractor to retrain employees in lockout/tagout procedures.
4. State the contractor requirements for personnel lockout/tagout training, and what that training shall include.
5. State the procedure that a contractor must use for releasing machines or equipment from lockout or tagout.
6. State the requirements for standardized lockout and tagout devices.
7. State the actions that must be taken if a tagout cannot be attached directly to an energy-isolating device.
8. List the elements of lockout/tagout procedures in the proper sequence.

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Note: If you think that you can complete the practice at the end of this level without working through the instructional material and/or examples, complete the practice now. The course manager will check your work. You will need to complete the practice at this level successfully before taking the criterion test.

RESOURCES

29 CFR 1910.147, The Control of Hazardous Energy (Lockout/Tagout), 7/1/97.

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INTRODUCTION

The Familiar Level of this module is divided into two sections. In the first section, we will discuss the purpose of 29 CFR 1910.147 and the terms associated with the standard. In the second section, we will discuss the requirements in the standard. We have provided examples throughout the module to help familiarize you with the material. The examples will also help prepare you for the practice at the end of this module and the criterion test.

Most of what you will need to know to complete this module is contained in the module. However, before continuing, you should obtain a copy of the standard. Copies of the standard are available on the Los Alamos National Laboratory Website at <http://iosun.lanl.gov:1776/htmls/directives.html> or through the course manager.. You may need to refer to the standard to complete the examples, practice, and criterion test.

SECTION 1 INTRODUCTION

PURPOSE

This standard covers the servicing and maintenance of machines and equipment in which the unexpected energization or start up of the machines or equipment, or release of stored energy could cause injury to employees. This standard establishes minimum performance requirements for the control of such hazardous energy.

DEFINITIONS

29 CFR 1910.147 contains several definitions. Some of those definitions are repeated here for your convenience. These definitions may differ from those contained in the standard. Additionally, terms that are in the standard but not in this section may appear in the examples, practice, and/or the criterion test. Therefore, it is important that you are familiar with the standard and this instructional material.

Affected Employee

An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Authorized Employee

A person who locks out or tags out machines or equipment to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered in this standard.

Energy Isolating Device

A mechanical device that physically prevents the transmission or release of energy, including:

- a manually operated electrical circuit breaker;
- a disconnect switch;
- a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors, and, in addition, no pole can be operated independently;
- a line valve;
- a block; and
- any similar device used to block or isolate energy. Push buttons, selector switches and other control circuit type devices are not energy isolating devices.

Hot Tap

A procedure used in the repair, maintenance, and services activities that involves welding on a piece of equipment (pipelines, vessels or tanks) under pressure to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

Lockout

The placement of a lockout device on an energy isolating device, according to an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout Device

A device that uses a positive means such as a lock, either key or combination type, to hold an energy isolating device in a safe position and prevent the energizing of a machine or equipment.

Tagout

The placement of a tagout device on an energy isolating device according to an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Tagout Device

A prominent warning device, such as a tag and a means of attachment, that can be securely fastened to an energy isolating device according to an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Note: You do not have to do example 1 on the following page, but it is a good time to check your skill or knowledge of the information covered. You may do example 1 or go to Section 2.

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EXAMPLE 1

Using the Familiar Level of this module and the resources, complete the following exercises.

1. State in your words what the DOE hopes to achieve by implementing 29 CFR 1910.147.

2. Define the following terms
Affected employee

Hot tap

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Lockout device

Note: When you have finished, compare your answers to those contained in the example 1 self-check. When you are satisfied with your answers, go to Section 2.

EXAMPLE 1 SELF-CHECK

1. State in your words what the DOE hopes to achieve by implementing 29 CFR 1910.147.
This standard covers the servicing and maintenance of machines and equipment in which the unexpected energization or start up of the machines or equipment, or release of stored energy could cause injury to employees. This standard establishes minimum performance requirements for the control of such hazardous energy.

2. Define the following terms

Affected employee

An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Hot tap

A procedure used in the repair, maintenance and services activities that involves welding on a piece of equipment (pipelines, vessels or tanks) under pressure, in order to install connections or appurtenances. It is commonly used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

Lockout device

A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in a safe position and prevent the energizing of a machine or equipment.

SECTION 2, REQUIREMENTS

In this section, we will describe some requirements related to lockout/tagout. The material is paraphrased from the standard contained in this module. Additionally, requirements that are in the standard but are not in this section may appear in the example, practice, or criterion test. Therefore, it is important that you are familiar with the standard and this instructional material.

GENERAL

Energy Control Program

The employer shall establish a program consisting of energy control procedures, employee training and periodic inspections to ensure that before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start up or release of stored energy could occur and cause injury, the machine or equipment shall be isolated from the energy source, and rendered inoperative.

Lockout/Tagout

If an energy isolating device is not capable of being locked out, the employer's energy control program shall use a tagout system.

If an energy isolating device is capable of being locked out, the employer's energy control program shall use lockout, unless the employer can demonstrate that the use of a tagout system will provide full employee protection.

After January 2, 1990, whenever replacement or major repair, renovation or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machine or equipment shall be designed to accept a lockout device.

Energy Control Procedure

Procedures shall be developed, documented and used for the control of potentially hazardous energy when employees are engaged in the activities covered in this standard.

The procedures shall clearly and specifically outline the scope, purpose, authorization, rules, and techniques to be used for the control of hazardous energy, and the means to enforce compliance including the following:

- A specific statement of the intended use of the procedure;
- Specific procedural steps for shutting down, isolating, blocking, and securing machines or equipment to control hazardous energy;
- Specific procedural steps for the placement, removal and transfer of lockout devices or tagout devices and the responsibility for them; and
- Specific requirements for testing a machine or equipment to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures.

Protective Materials and Hardware

Locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware shall be provided by the employer for isolating, securing, or blocking machines or equipment from energy sources.

Lockout devices and tagout devices shall be singularly identified; shall be the only device(s) used for controlling energy; shall not be used for other purposes; and shall meet the following requirements:

- **Durable.** Lockout and tagout devices shall be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected. Tagout devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible. Tags shall not deteriorate when used in corrosive environments such as areas where acid and alkali chemicals are handled and stored.
- **Standardized.** Lockout and tagout devices shall be standardized within the facility in at least one of the following criteria: Color; shape; or size; and additionally, in the case of tagout devices, print and format shall be standardized.
- **Substantial.** Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting tools. Tagout devices, including their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and having the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.

- Identifiable. Lockout devices and tagout devices shall indicate the identity of the employee applying the device(s). Tagout devices shall warn against hazardous conditions if the machine or equipment is energized and shall include a legend such as the following: Do Not Start, Do Not Open, Do Not Close, Do Not Energize, Do Not Operate.

Periodic Inspection

The employer shall conduct a periodic inspection of the energy control procedure at least annually to ensure that the procedure and the requirements of this standard are being followed.

The periodic inspection shall be performed by an authorized employee other than the one(s) using the energy control procedure being inspected.

The periodic inspection shall be conducted to correct any deviations or inadequacies identified.

Where lockout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected.

Where tagout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized and affected employee, of that employee's responsibilities under the energy control procedure being inspected, and the elements set forth in this standard.

The employer shall certify that the periodic inspections have been performed. The certification shall identify the machine or equipment on which the energy control procedure was being used, the date of the inspection, the employees included in the inspection, and the person performing the inspection.

Training and Communication

The employer shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of the energy controls are acquired by employees. The training shall include the following:

- Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control.
- Each affected employee shall be instructed in the purpose and use of the energy control procedure.
- All other employees whose work operations are or may be in an area where energy control procedures may be used, shall be instructed about the procedure, and about the prohibition relating to attempts to restart or reenergize machines or equipment that are locked out or tagged out.

When tagout systems are used, employees shall also be trained in the following limitations of tags:

- Tags are essentially warning devices affixed to energy isolating devices, and do not provide the physical restraint on those devices that is provided by a lock.
- When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.
- Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, to be effective.
- Tags and their means of attachment must be made of materials that will withstand the environmental conditions encountered in the workplace.
- Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.
- Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

Employee retraining

- Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures.
- Additional retraining shall also be conducted whenever a periodic inspection reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures.
- The retraining shall reestablish employee proficiency and introduce new or revised control methods and procedures, as necessary.

The employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee's name and dates of training.

Energy Isolation

Lockout or tagout shall be performed only by the authorized employees who are performing the servicing or maintenance.

Notification of Employees

Affected employees shall be notified by the employer or authorized employee of the application and removal of lockout devices or tagout devices. Notification shall be given before the controls are applied, and after they are removed from the machine or equipment.

APPLICATION OF CONTROL

The established procedures for the application of energy control (the lockout or tagout procedures) shall cover the following elements and actions and shall be done in the following sequence:

1. Preparation for shutdown. Before an authorized or affected employee turns off a machine or equipment, the authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.
2. Machine or equipment shutdown. The machine or equipment shall be turned off or shut down using the procedures established for the machine or equipment. An orderly shutdown must be used to avoid any additional or increased hazard(s) to employees as a result of the equipment stoppage.

3. Machine or equipment isolation. All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated to isolate the machine or equipment from the energy source(s).
4. Lockout or tagout device application. Lockout or tagout devices shall be affixed to each energy isolating device by authorized employees. Lockout devices, where used, shall be affixed so that they will hold the energy isolating devices in a safe or off position. Tagout devices, where used, shall be affixed so that they clearly indicate that the operation or movement of energy isolating devices from the safe or off position is prohibited. Where tagout devices are used with energy isolating devices designed with the capability of being locked, the tag attachment shall be fastened at the same point at which the lock would have been attached. Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.
5. Stored energy. Following the application of lockout or tagout devices to energy isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, and otherwise rendered safe. If there is a possibility of reaccumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists.
6. Verification of isolation. Before starting work on machines or equipment that have been locked out or tagged out, the authorized employee shall verify that isolation and deenergization of the machine or equipment have been accomplished.

RELEASE FROM LOCKOUT OR TAGOUT

Before lockout or tagout devices are removed and energy is restored to the machine or equipment, procedures shall be followed and actions taken by the authorized employee(s) to ensure the following:

- The work area shall be inspected to ensure that nonessential items have been removed and to ensure that machine or equipment components are operationally intact.
- The work area shall be checked to ensure that all employees have been safely positioned or removed. After lockout or tagout devices have been removed and before a machine or equipment is started, affected employees shall be notified that the lockout or tagout device(s) have been removed. Each lockout or tagout device shall be removed from each energy isolating device by the employee who applied the device except when the authorized

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employee who applied the lockout or tagout device is not available to remove it. That device may be removed under the direction of the employer, provided that specific procedures and training for such removal have been developed, documented and incorporated into the employer's energy control program. The employer shall demonstrate that the specific procedure provides equivalent safety to the removal of the device by the authorized employee who applied it. The specific procedure shall include at least the following elements: Verification by the employer that the authorized employee who applied the device is not at the facility. Making all reasonable efforts to contact the authorized employee to inform him/her that his/her lockout or tagout device has been removed, and ensuring that the authorized employee has this knowledge before he/she resumes work at that facility.

Note: You do not have to do example 2 on the following page, but it is a good time to check your skill or knowledge of the information covered. You may do the example or go to the practice.

EXAMPLE 2

1. Describe the eight conditions that must exist to exempt a machine or equipment from the requirement to develop an energy control procedure for that machine or equipment.
2. State the criteria for standardizing lockout/tagout devices.
3. Describe the conditions under which someone other than the authorized employee may remove a lockout/tagout device.

<p>Note: When you are finished, compare your answers to those contained in the example 2 self-check. When you are satisfied with your answers, go on to Section 3</p>
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EXAMPLE 2 SELF-CHECK

1. Describe the eight conditions that must exist to exempt a machine or equipment from the requirement to develop an energy control procedure for that machine or equipment.
The employer need not document the required procedure for a particular machine or equipment, when all of the following elements exist:
 - The machine or equipment has no potential for stored or residual energy or reaccumulation of stored energy after shut down which could endanger employees.
 - The machine or equipment has a single energy source that can be readily identified and isolated.
 - The isolation and locking out of that energy source will completely deenergize and deactivate the machine or equipment.
 - The machine or equipment is isolated from that energy source and locked out during servicing or maintenance.
 - A single lockout device will achieve a locked-out condition.
 - The lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance.
 - The servicing or maintenance does not create hazards for other employees.
 - The employer, in using this exception, has had no accidents involving the unexpected activation or reenergization of the machine or equipment during servicing or maintenance.
2. State the criteria for standardizing lockout/tagout devices.
Lockout and tagout devices shall be standardized within the facility in at least one of the following criteria: Color; shape; or size; and additionally, in the case of tagout devices, print and format shall be standardized.
3. Describe the conditions under which someone other than the authorized employee may remove a lockout/tagout device.
When the authorized employee who applied the lockout or tagout device is not available to remove it, that device may be removed under the direction of the employer, provided that specific procedures and training for such removal have been developed, documented and incorporated into the employer's energy control program. The employer shall demonstrate

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that the specific procedure provides equivalent safety to the removal of the device by the authorized employee who applied it. The specific procedure shall include at least the following elements:

- Verification by the employer that the authorized employee who applied the device is not at the facility;
- Making all reasonable efforts to contact the authorized employee to inform him/her that his/her lockout or tagout device has been removed; and
- Ensuring that the authorized employee has this knowledge before he/she resumes work at that facility.

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This practice is required if your proficiency is to be verified at the familiar or general level. This practice will prepare you for the criterion test that will be required if your proficiency is to be verified at the general level. You will need to refer to the Orders to answer the questions in the practice correctly. The practice and criterion test will also challenge additional skills that you have acquired in other formal and on-the-job training.

PRACTICE

1. Define the following terms.
Authorized employee

Tagout

Lockout device

Tagout device

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2. State the conditions that require a contractor to retrain employees in lockout/tagout procedures.
3. State the actions that must be taken if a tagout device cannot be attached directly to an energy-isolating device.
4. List four elements that should be included in lockout/tagout procedures.

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5. State four requirements associated with conducting periodic inspections.

6. State three elements that should be included in an employee training program for lockout procedures.

Note: The course manager will check your practice and verify your success at the familiar level. When you have successfully completed this practice, go to the general level.

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THE CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)
GENERAL LEVEL

OBJECTIVES

Given the Familiar Level of this module, and a scenario, you will be able to perform the following:

1. List the key elements you would look for in the contractor's action plan to correct the situation described in the scenario; and
2. State which requirements, sections, or elements of 29 CFR 1910.147 apply to the situation described in the scenario.

Note: If you think that you can complete the practice at the end of this level without working through the instructional material and/or the examples, complete the practice now. The course manager will check your work. You will need to complete the practice in this level successfully before taking the criterion test.

RESOURCES

DOE Orders Self-Study Program, 29 CFR 1910.147, Familiar Level, 7/24/98.
29 CFR 1910.147, The Control of Hazardous Energy, 7/1/97.

INTRODUCTION

The Familiar Level of this module introduced the purpose and scope of 29 CFR 1910.147. Several definitions and the requirements associated with the standard were discussed. In the General Level of this module, students are asked to apply the information contained in the Familiar Level and the standard to a scenario related to the standard. Please refer to the resources listed on the previous page to make your analysis and answer the questions. You are not required to complete the example. However, doing so will help prepare you for the practice and criterion test.

Note: You do not have to do the example on the following page, but it is a good time to check your skill and knowledge of the information covered. You may do the example or go on to the practice.

EXAMPLE SCENARIO

Please review the following scenario, and then answer these questions.

1. Is the contractor's action plan correct? If not, state what should have been done.
2. Were the correct documents or requirements cited? If not, state the correct documents or requirements.

SCENARIO

On December 5, 1996, at the in-tank precipitation facility, an electrical and instrumentation (E&I) mechanic lifted and taped an incorrect lead while installing a lockout. A facility operator installed a tag on the lead and signed the lockout. Another operator verified and initialed the lockout step as being correct. A construction worker conducting zero energy checks recognized that the incorrect lead had been lifted, tagged, and taped. The construction worker stopped work and notified the shift manager. The shift manager verified the incorrect lead had been lifted.

An investigation of the situation revealed the following.

- The first and second lockout/tagout (L/T) operators did have a concern about the discrepant as-written L/T order and the as-found field conditions. This concern was raised to the shift supervisor on duty. However, the question the operators thought they were asking and the question the shift supervisor thought he was being asked were not the same. The operators were asking if they should lift one particular wire or another one, since the labels did not correspond. The shift supervisor believed they were asking for permission to proceed. There was no further questioning or clarification requested of the original question's intent.
- Historically, operations interpreted lockout/tagout operator, and authorized employee, to mean that only operators (that is, personnel assigned to the operations group) were allowed to hang and independently verify the hanging of lockout tags. These personnel, however, were not properly trained on the identification of electrical components. E&I personnel, on the other hand, were properly trained on the identification of electrical components, and were the ones most qualified to lift leads and hang appropriate lockout tags, but they were not permitted to do so according to operations' interpretation of the procedure.
- The cabinet in which these leads are located is too congested to read the labels easily and clearly.

- To physically permit a tag to be hung, the appropriate lead must be lifted first. The E&I mechanic performing the task did not follow the cable legend and equipment legend correctly. The wrong lead was lifted. This resulted in the operator's inability to verify the L/T order against the field conditions when they attempted to hang the lockout tag.

Actions taken by the contractor

- Rewrite the lockout/tagout package to include the correct description of the circuit.
- Reinstall the tag and independently verify it is correct.
- Revise the lockout/tagout procedure to allow lifting leads only if E&I mechanics fill out a lifted leads form with independent verification.
- Issue shift orders reinforcing the requirement to stop work when procedures do not match actual conditions.
- Communicate to the affected E&I employee the gravity of this incident, and implement constructive discipline.
- Retrain operators on requirements of lockout/tagout and independent verification.

Requirements applicable to this situation:

29 CFR 1910.147, paragraph (c)(8)

Energy isolation, lockout or tagout shall be performed only by authorized employees who are performing the servicing or maintenance.

29 CFR 1910.147, paragraph (d)(6)

Before starting work on machines or equipment that have been locked out or tagged out, the authorized employee shall verify that isolation and deenergization of the machine or equipment have been accomplished.

Take some time to review the example scenario and the contractor actions taken to correct the situation. Then decide if all the correct actions were considered and if the appropriate requirements (from those included in this module) were selected. Write your answer below, and then compare your answer to the one contained in the example self-check.

EXAMPLE SELF-CHECK

Your answer does not have to match the following exactly. You may have added more corrective actions or cited other requirements that apply. To be considered correct, your answer must include at least the following.

The actions listed are correct. One additional action should be considered. Employees should be retrained to ensure they understand what an authorized employee is.

The requirements cited are correct. There are two additional requirements that should have been mentioned. The definition of authorized employee should also be clarified.

29 CFR 1910.147, paragraph (c)(7) (i)

The employer shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of the energy controls are acquired by employees.

29 CFR 1910.147, paragraph (c)(7)(iii)(B)

Additional retraining shall be conducted whenever the employer has reason to believe that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures.

29 CFR 1910.147, Section (b)

An authorized employee is a person who locks out or tags out machines or equipment to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section.

PRACTICE

This practice is required if your proficiency is to be verified at the General Level. The practice will prepare you for the criterion test. You will need to refer to the Order to answer the questions in the practice correctly. The practice and criterion test will also challenge additional analytical skills that you have acquired in other formal and on-the-job training.

Please review the following scenario and answer the following questions.

1. Was the situation handled correctly? If not, what should have been done?
2. Was the list of requirements, sections, and elements complete and correct? If not, state the correct or omitted requirements.

SCENARIO

Two electricians were performing 3-year preventive maintenance on a 480-volt switch-gear motor control center at the high flux isotope reactor. The maintenance work package instructed them to clean, inspect, and test the motor control center panels. They commenced the work on September 23. At that time, a lockout/tagout was in place, and the electricians performed a zero-energy check and verified that the switchgear was de-energized. Operators cleared the lockout on September 26 after the electricians completed maintenance on one of two panels. On September 27, the two electricians continued the preventive maintenance under a new lockout/tagout. They assumed, because the equipment was de-energized the previous week with a similar lockout, that they did not have to perform another zero energy check. One of the electricians placed his hand on an energized incoming feed and received an electrical shock.

Investigators determined that operators installed an inadequate lockout/tagout of the motor control center on Saturday because the second panel had two electrical feeds and the lockout preparer failed to identify the second source of power.

Actions taken by the contractor.

- Medical personnel treated the electrician for a minor burn on the hand and released him to return to work.
- The facility manager stopped all electrical work at the high flux isotope reactor site.
- A shift supervisor conducted an independent review of each active lockout/tagout to verify the adequacy of the lockout/tagout.

Applicable requirements:

29 CFR 1910.147, paragraph (c) (1)

The employer shall establish a program consisting of energy control procedures, employee training and periodic inspections to ensure that before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start up or release of stored energy could occur and cause injury, the machine or equipment shall be isolated from the energy source, and rendered inoperative.

29 CFR 1910.147, paragraph (d)(1)

Before an authorized employee turns off a machine, the authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

Take some time to review the scenario and the actions the contractor took or did not take to correct the situation. Then decide if the contractor's actions were complete and correct. Finally, determine if the requirements, sections, or elements cited in the scenario were correct.

Use the space below and on the next page to write your answer and then bring the completed practice to the course manager for review.

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Note: The course manager will check your practice and verify your success at the General Level. When you have successfully completed this practice, the course manager will give you the criterion test.